

What is claimed is:

1. A method of estimating substrate temperature, comprising the steps of:

epitaxially growing a first semiconductor layer on a substrate for temperature estimation, the first semiconductor layer being made of a single crystal material having an optical constant that is different from an optical constant of the substrate for temperature estimation, and then epitaxially growing a second semiconductor layer on the first semiconductor layer under a reaction control condition, the second semiconductor layer being made of a single crystal material having an optical constant that is substantially equal to the optical constant of the substrate for temperature estimation and different from the optical constant of the first semiconductor layer;

measuring a film thickness of the second semiconductor layer by a method of optical measurement and measuring a surface temperature of the second semiconductor layer;

calculating a rate of growth of the second semiconductor layer based on the film thickness of the second semiconductor layer thus measured to derive a relationship between the rate of growth of the second semiconductor layer and the surface temperature of the second semiconductor layer;

epitaxially growing a third semiconductor layer on a substrate for device fabrication made of a material identical to a material of the substrate for temperature estimation, the third semiconductor layer being made of a single crystal material having an optical constant that is different from the optical constant of the substrate for device fabrication, and then epitaxially growing a fourth semiconductor layer on the third semiconductor layer under a reaction control condition, the fourth semiconductor layer being made of a single crystal

material having an optical constant that is substantially equal to the optical constant of the substrate for device fabrication and different from the optical constant of the third semiconductor layer;

measuring a film thickness of the fourth semiconductor layer by a method of optical measurement;

calculating a rate of growth of the fourth semiconductor layer based on the film thickness of the fourth semiconductor layer thus measured; and

estimating a surface temperature of the fourth semiconductor layer based on the rate of growth of the fourth semiconductor layer thus calculated and the relationship.

2. The method of estimating substrate temperature according to claim 1, wherein the second semiconductor layer and the fourth semiconductor layer are each comprised of a semiconductor layer containing Si.

3. The method of estimating substrate temperature according to claim 2, wherein the second semiconductor layer and the fourth semiconductor layer each further contains Ge.

4. The method of estimating substrate temperature according to claim 2, wherein the second semiconductor layer and the fourth semiconductor layer each further contains C.

5. The method of estimating substrate temperature according to claim 3, wherein the second semiconductor layer and the fourth semiconductor layer each further contains C.

6. The method of estimating substrate temperature according to claim 1, wherein the substrate for temperature estimation, the second semiconductor layer, the substrate for device fabrication and the fourth semiconductor layer are each made of Si.

7. The method of estimating substrate temperature according to claim 1, wherein the second semiconductor layer is made of Si, and the first semiconductor layer is made of SiGe.

8. The method of estimating substrate temperature according to claim 7, wherein the first semiconductor layer has a Ge composition ratio not less than 5% and a film thickness equal to or less than a critical film thickness thereof.

9. The method of estimating substrate temperature according to claim 1, wherein the second semiconductor layer is made of Si, and the first semiconductor layer is made of SiGeC.

10. The method of estimating substrate temperature according to claim 1, wherein the film thickness of the second semiconductor layer is measured with use of a spectroscopic ellipsometer.

11. The method of estimating substrate temperature according to claim 1, wherein the film thickness of the second semiconductor layer is measured with use of a spectral reflectometer.

12. The method of estimating substrate temperature according to

claim 1, wherein:

a plurality of fourth semiconductor layers are epitaxially grown on the third semiconductor layer under a reaction control condition;

in the step of calculating the rate of growth of the fourth semiconductor layer, rates of growth of at least two of the plurality of fourth semiconductor layers are calculated; and

in the step of estimating the surface temperature of the fourth semiconductor layer, surface temperatures of the at least two of the fourth semiconductor layers are estimated based on the rates of growth of the at least two of the fourth semiconductor layers thus calculated.